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Journal of the Society of Arts.

FRIDAY, SEPTEMBER 10, 1869.

Announcements by the Council.

Notice to Institutions.

A copy of Vol. I. of the "Reports on the Paris Universal Exhibition of 1867" has been forwarded to each Institution in Union with the Society. This volume completes the set of six, five having already been sent to the Institutions, in October, 1868. With this volume has been also sent a copy of the Report of Her Majesty's Commissioners for the Paris Exhibition.

Improved Cabs.

The Council of the Society of Arts offer the following medals for improved hackney carriages specially suited to the metropolis :—

The Society's Gold Medal for the best and most convenient open hackney carriage for two persons.

The Society's Silver Medal for the second-best ditto.

The Society's Gold Medal for the best and most convenient closed hackney carriage for two persons.

The Society's Silver Medal for the second-best ditto.

The Society's Gold Medal for the best and most convenient hackney carriage for four persons, either open or closed, or both.

The Society's Silver Medal for the second-best ditto.

Lightness of construction, combined with adequate strength and durability, will be especially considered in making the awards.

The awards will be made after actual trials of the carriages extending over a certain period.

Communications describing the carriages must be sent to the Secretary of the Society of Arts before the 1st January, 1870, the carriages to be sent to a place hereafter to be appointed.

The Council also offer the Society's Silver Medal for the best instrument, to be affixed to a cab or other hackney carriage, for indicating the fare as between the passenger and the driver, whether by registering the distance travelled or otherwise, and which instrument shall also indicate, for the convenience of the cab-owner and of the driver, the total distance travelled during the day and the total amount earned. The instruments competing, with full descriptions of their construction, to be sent to the Society's House before the 1st January, 1870.

Competitors may, at their option, sign their communications, or may forward with them sealed letters containing the name and address of the writer.

The Council reserve to themselves the right of withholding all or any of the medals, in case none of the carriages or instruments possess, in their opinion, sufficient merit.

In the trials of the several carriages, the small amount of vibration and noise will be duly considered by the judges.

Designs for Channel Steamers.

The very defective state of the accommodation afforded by the Channel steamers, plying between this country and the Continent, having been brought under the notice of the Council, they have determined to offer the Gold Medal of the Society, and the large Silver Medal of the Society, for the best and the second-best block model of a steamer, which shall afford the most convenient shelter and accommodation to passengers on the deck of the vessel crossing the Channel between France and England. The steamer is not to exceed in tonnage and draught the best vessels now in use between Folkestone and Boulogne, and the model must be on a scale of a quarter of an inch to a foot. The models, marked in cypher, are to be sent in to the Society of Arts' House, John-street, Adelphi, on or before the 1st November, 1869, with a sealed envelope, giving the name and address of the designer.

The Council reserve the right of withholding either or both medals, in case, in their opinion, the models sent in do not possess sufficient merit.

The following particulars of the South-Eastern Channel steamers, *Victoria*, *Albert Edward*, and *Alexandra*, are given for the convenience of competitors, but it is not intended to confine the designs to them, except as to tonnage and draught :—

Length between perpendiculars, 200 ft.
Breadth of beam, 24 ft.
Depth underside of deck amidships, 12 ft. 6 in.
Draught of water, 7 ft.
Bow, clipper.
Stern, elliptic.
Rig, polacca with two masts, lug foresail, gaff mainsail, staysail, and flying jib.
Engines, oscillating.
Paddle wheels, 17 ft. 6 in. diameter.
Tonnage, 568 tons.
Speed, 17 miles an hour.

Subscriptions.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of Institutions.

EXAMINATION PAPERS, 1869.

(*Continued from page 780.*)

The following are the Examination Papers set in the various subjects at the Final Examination held in April last :—

CHEMISTRY.

THREE HOURS ALLOWED.

No candidate is allowed to answer more than three questions in each division.

FIRST DIVISION.

1. Describe experiments by which you could prove that air, deprived of its minor constituents, consists of nitrogen and oxygen.

2. What grounds have you for believing that the oxygen of atmospheric air is not combined with the nitrogen, but only mixed with it?

3. How would you ascertain whether an ammonia-salt is present in a given solution?

4. What are the chief constituents of coal-gas? How could you distinguish marsh gas from olefiant gas?

5. A sample of chalk is said to contain phosphoric acid. How would you ascertain whether the acid is present?

6. Describe by equations the action of dilute sulphuric acid on bicarbonate of soda, on nitrate of lead, and on chloride of calcium.

SECOND DIVISION.

1. How would you separate tin from antimony?

2. How is lead separated from silver by Pattinson's process?

3. A solution acid to test paper gives a white precipitate on the addition of hydrochloric acid. What may the precipitate contain? How would you examine it?

4. How is aluminic chloride prepared from a ferruginous mineral?

5. How is quicklime prepared? What admixture does it commonly contain, and what influence has this admixture on its properties?

6. How is potassic chlorate prepared?

THIRD DIVISION.

1. How is acetic acid obtained from wood?

2. Describe the action of chlorine on marsh gas, and the general properties of the product formed.

3. How is aldehyde obtained in a pure state from the products of oxidation of alcohol?

4. How is tartaric acid prepared in a pure state from cream of tartar? Give its formula and those of its chief salts.

5. A volatile organic base is given containing carbon, hydrogen, and nitrogen. How could you ascertain whether it is a primary, a secondary, or a tertiary derivative of ammonia?

6. How is sugar deprived most completely of the foreign bodies which occur mixed with it, in so-called moist sugar?

MINING AND METALLURGY.

THREE HOURS ALLOWED.

Six questions to be answered.

1. The water flowing into the workings of a mine amounts to 864,000 gallons in twenty-four hours. What will be the diameter of the pump required for its extraction if the stroke be six feet, and the number of strokes per minute ten?

2. Briefly describe the various methods employed for the ventilation of mines.

3. Which are the most important tin-producing countries of the world, and by what means is tin ore prepared for metallurgical treatment?

4. What do you, severally, understand by the terms *vein*, *seam*, and *deposit?*

5. Describe the ordinary volumetric process for the estimation of copper by means of a standard solution of cyanide of potassium.

6. How would you ascertain the amount of lead, silver, and gold contained in a specimen of galena?

7. Describe the process of converting iron into steel by cementation.

8. How, on a large scale, is metallic antimony obtained from the native sulphide of that metal?

9. Describe the processes commonly employed for the extraction of gold from auriferous veinstone.

10. From what sources is sulphur commercially obtained?

11. Describe the processes by which pig-iron is converted into merchant bars.

12. How would you estimate the amount of zinc contained in an ore of that metal?

BOTANY.

THREE HOURS ALLOWED.

The candidate is expected to answer correctly three questions in Section I. and six questions in Sections II. and III., including descriptions of at least two of the fresh specimens. Nos. 8, 9, *and* 10 *each stand for an answer.*

SECTION I.—STRUCTURE AND PHYSIOLOGY.

1. Define the following terms, giving an example in illustration of each:—*Distractile, Homogamous, Loculicidal, Lyrate.*

2. Describe the origin, function, and mode of growth of *roots*, noting the particulars in which they generally differ from stem-structures. If the extremity of a root be removed, what follows? And is such removal useful under any circumstances?

3. What is *Transpiration?* What external conditions affect it?

4. Give the principal insoluble *Cell-contents*, stating briefly the characters of each.

5. What is *Albumen?* How does it originate?

6. Enumerate the principal forms of *Inflorescence* distinguished by special names, giving a species in illustration of each.

SECTION II.—SYSTEMATIC AND ECONOMIC BOTANY.

1. Which natural orders furnish the following products? State the part of the plant affording each. *Vanilla, Flax, Cream of Tartar, Tapioca, Valonia, Chicory.*

2. Enumerate the genera of indigenous *British Trees*, giving the natural order to which they respectively belong.

3. Name the natural orders of British Dicotyledons in which the stamens are *opposite* to the petals or to the lobes of the corolla.

4. Distinguish Liliaceae from Amaryllidaceæ, Iridaceæ, Juncaceæ, and Alismaceæ.

5. How does Barley *(Hordeum)* differ from Rye *(Secale)?*

6. Give the general characteristics of *Lichenes.*

7. Name the natural orders to which the three plants marked A, B, and C respectively belong, *with the reasons* for your opinion.

SECTION III.—DESCRIPTIVE BOTANY.

8, 9, 10. Describe the three plants marked A, B, and C, noticing the various organs in their proper sequence.

FLORICULTURE.

THREE HOURS ALLOWED.

1. What is the difference between a Tuber and a Corm, and how does any difference which may exist affect the propagation of the plants by which they are respectively formed? Name examples.

2. Explain in what respects the germination of a seed differs from that of a spore.

3. What use do you attribute to the stomates in the leaves of plants?—on which surface of the leaf are they as a rule most abundant?—and what do your conclusions on these points suggest to you as regards the cultural treatment of the plants?

4. Indicate the general features of the treatment you would give to a Fuchsia, a Tulip, an Odontoglossum, and a Globe Amaranth?

5. Name the best half-dozen Marantas known to you, and note down the colours of their leaves.

6. Name the best half-dozen evergreen trailing plants suitable for covering a garden wall, and hardy in the climate of London.

7. What treatment would you resort to in order to restore greenhouse plants which had been accidentally frozen?

8. Name what you regard as the best 12 Hardy Perennials of distinct character, excluding all garden varieties. The points of merit to be—facility of culture, intrinsic beauty, and duration of bloom.

9. Is the root action of plants continuous or intermittent? Mention illustrative cases which you may have specially noticed.

10. Set down the names of the coloured-leaved varieties of Coleus known to you.

11. How would you cultivate Tree Pæonies?

12. Point out in what particulars the plants classed as Parasitical, Epiphytal, and Terrestrial, differ in respect to the characteristics here mentioned, and refer to examples of each class.

FRUIT AND VEGETABLE CULTURE.

THREE HOURS ALLOWED.

FRUIT CULTURE.

1. If you were required to plant an acre of ground as a fruit garden, what steps would you take in the preparation of it before planting the trees?

2. A quarter of an acre will take 108 pyramidal trees at ten feet apart; what varieties and how many of each, apples, pears, plums, and cherries, would you select to plant it with?

3. What are the different stocks usually employed on which to graft the apple, pear, and plum?

4. How would you distinguish a Jefferson plum from a Green Gage?

5. In the summer the plum and cherry are frequently infested with the blue aphis, which retards the growth and impairs the vigour of the trees. What remedy would you employ to destroy it?

6. In what way does root-pruning induce fertility in fruit trees?

VEGETABLE CULTURE.

7. Prepare a list of seeds necessary to supply a garden of an acre in extent.

8. If you were to sow Champion of England and Veitch's Perfection Peas on the same day and on the same piece of ground, which of them would come into use first?—and how would you distinguish the one from the other?

9. What is Rampion, and how is it cultivated?

10. Write a short treatise on an approved method of cultivating horse-radish.

11. What is the difference between the artichoke and cardoon, and for what purpose is each cultivated?

12. Write a short treatise on the cultivation of cucumbers in pots.

ANIMAL PHYSIOLOGY.

THREE HOURS ALLOWED.

No candidate will be allowed to pass who does not satisfactorily answer three of the four questions which follow. He may answer any three, but not more than three.

1. Of what alimentary principles (food-stuffs), and of how much of each, ought a man's daily food to consist?

2. In what respects does the circulation of blood through the lungs differ from the circulation of blood through the liver?

3. In what respects does the skin of the tip of the finger differ from the skin of the heel?

4. What is the spinal cord? Where is it situate? What is its structure?

Candidates who desire to be placed in the first or second class may, in addition, answer one of the two following questions:—

5. What are the microscopical characters and chemical constituents of human blood? Enumerate the differences found in blood drawn from the pulmonary, hepatic, renal, and jugular veins.

6. Describe the position and structure of the retina. State what is known of the functions of its various parts. How is it that with two eyes we see single?

(*To be continued.*)

CHANNEL PASSAGES BETWEEN ENGLAND AND FRANCE.

Captain Tyler, R.E., has, in compliance with instructions from the Board of Trade, visited the French and English coasts, with a view to preliminary inquiry as to the improvements which may be effected in the means of communication between the two countries. His report has just been printed by order of the House of Commons. He was accompanied in his inspection by Mr. Eborall, the General Manager of the South-Eastern Railway; Captain Boxer, R.N., the Harbour-Master at Folkestone and Superintendent of the South-Eastern Company's Steamers; and Mr. Brady, one of the engineers of the South-Eastern Railway; and he had the advantage of conferring with the Mayor of Boulogne, the President and certain members of the Chamber of Commerce of Boulogne, the Engineer-in-Chief of the *Ponts-et-Chaussées* for that part of the French coast, M. Le Gros, and the Engineers of the ports of Boulogne and Calais, M. Le Blanc and M. Æron; the General Manager of the Northern Railway of France, M. Pétiet; the General Manager of the London, Chatham, and Dover Railway, Mr. Forbes; the Superintendent of the London, Chatham, and Dover Company's steamers, Captain Morgan, R.N., the Engineer of the Pier at Dover, Mr. Druce, and several others.

In his report it appears that, "omitting from consideration the ports of Hamburg, Rotterdam, Antwerp, and Ostend, the passenger traffic between England and France, for the year 1868, amounted to 309,479 altogether; 141,633 passengers having travelled by Calais, 109,006 by Boulogne, 41,371 by Dieppe, and 17,469 by Havre. A large proportion of these, namely, 46,411, crossed the Channel in the month of August, as against 12,946 in January, and 13,514 in February. In the year 1867 (of the Paris Exhibition) the numbers were 454,350 altogether, 199,837 having travelled by Calais; 146,226 by Boulogne; 86,914 by Dieppe; and 21,373 by Havre. Of these 84,684 crossed in August, against 13,163 in January, and 13,721 in February. In addition to the ordinary annual increase, which is considerable, there would naturally be a very large augmentation in these numbers if better arrangements were made for crossing the Channel. Considering the restrictions as to dimensions which are imposed upon the South-Eastern and London, Chatham, and Dover Railway Companies by the circumstances of the harbours and the various conditions of the service, the steamers are admirably constructed for the work they are required to perform. But it is, nevertheless, an undoubted fact, that the great majority of these passengers suffer (short as is the sea passage) extreme discomfort from sea-sickness and want of shelter during bad weather. Not unfrequently, the traveller from India or from America finds the British Channel the most unpleasant part of his journey, and he sometimes looks forward with more anxiety to the state of the Channel than to the heat of the Red Sea or the passage of the Atlantic, selecting, in the case of America, a French or an English vessel, in order to avoid the Channel-crossing, according to the country which he desires to reach, rather than from any other consideration.

"As the mean of three years, Captain Boxer calculates, from his meteorological journal and from the journals of his steamers, that there are, out of the 365 days, 29 days of 'gales and storms, with heavy seas,' 102 days of 'good round sea and breezes,' 144 days with 'moderate weather and sea,' and 90 days of calm weather. It is, no doubt, partly from the check which winter weather exercises, that only 13,000 to 14,000 travellers pass between England and France in January and February, against 46,000 in August, and 310,000 in the year. It may, at any rate, be safely asserted that there is nowhere any sea service of equal importance which is so much in need of improvement. Between England and Ireland the service has now been conducted for many years in commodious vessels, and at fixed times, irrespective of tide or weather. Between Great Britain and Europe, for want of better harbour accommodation, it is found impossible to employ vessels of greater length than about 200 to 240 feet, or drawing more than 7 ft. to 8 ft. of water; and even those vessels cannot at times enter the French harbours, or land their passengers on the French coast."

He then proceeds to discuss the different modes by which this condition of affairs may be ameliorated, and enters into minute examination of the coast from Cape Alprech to Calais, within which lie the harbours of Boulogne and Calais, and the other spots which have been suggested as suitable for the establishment of harbours, and the capabilities of each. He considers that "Any other pier or breakwater, of whatever form or in whatever direction, would probably, sooner or later, lead to accumulation and obstruction; and as far, therefore, as an improved service with England is concerned, Calais does not appear to be the harbour to which attention should be directed. But it must not be forgotten that Calais has (while Boulogne forms the nearer route from London to Paris) the advantage of being a great centre of communication, *viâ* Brussels and Cologne, for Strasbourg, the Rhine, the North of Europe, and North and South Germany; and travellers proceeding in those directions would be taken considerably out of their course by steamers running to Boulogne. The books of the London, Chatham, and Dover Railway Company for the year ending 31st December, 1868, show that there were carried in that year by that company's boats between Dover and Calais altogether 133,670 passengers, of whom 77,443 were to or from Paris or places beyond it, 39,547 were to or from Belgium and Germany, and 16,680 were booked locally between Dover and Calais, so that their destination was not known."

In referring to Mr. Fowler's scheme for a harbour south of Cape Grisnez, at Audresselles, as the best point on the French coast for a harbour of communication, he says:—"Mr. Fowler has, for the last six or seven years, directed his attention to the question of the best mode of improving continental communication, and has preferred to advocate a system of ferrying the trains over in steam vessels rather than either a bridge, which he believed to be impracticable, or a tunnel, which he did not think likely to be undertaken. He has for the last two years associated with him Mr. Abernethy, and Mr. Wilson, as acting engineer. After a careful examination of the harbours of Calais and Boulogne, and the coast between them, and after considering the general question, they came to the conclusion that the following were essential requirements:—

"1. Well sheltered harbours, with deep water on both coasts, capable of affording ingress and egress at all times, irrespective of weather and tide.

"2. A class of vessels, in the nature of ferry-steamers, of greater size and power, making rapid passages, and comparatively unaffected by wind and sea.

"3. Safe and speedy means for the interchange of passenger traffic between the railways and such ferry-steamers, so as practically to form a continuous communiation.

"Conceiving that the harbour and pier at Dover afforded very inadequate terminal accommodation, and insufficient protection, particularly from easterly and south-easterly gales, they proposed the construction of a new harbour westward of the existing pier, with a graving dock, a covered berth for the steamers, and hydraulic apparatus for transferring the trains from the quay to the steamers, and *vice versâ*. They considered that Calais, which was exposed to all winds from west to east, and was choked up with sand, offered no facility for a harbour for such steamers; and that the harbour of Boulogne, though more readily capable of partial improvement, partook of the same natural defect of sand accumulation. They, therefore, selected a point of the coast south of Cape Grisnez and north of Ambleteuse, near the village of Audresselles, where the deepest water was to be found near the coast, and sheltered from the northward and eastward by Cape Grisnez; and they considered that, by constructing a harbour at this point, they would secure the shortest available sea passage, with clear navigation across the Channel from Dover, and with the advantage of the first-class light on Cape Grisnez as a guide on the darkest nights. They proposed to connect this harbour by a railway four miles long with the 'Chemin de Fer du Nord,' and to add a short branch for communication with Calais and the north.

"They proposed further to employ between these harbours, steamers 450 feet long, with 57 feet of beam, and 80 feet across the paddle-boxes, propelled by disconnected engines of 1,500 horse-power, performing the voyage in one hour, and with comparatively little pitching or rolling in any state of the weather; and to form covered stations for the interchange of passenger and goods traffic between the steamers and the shore, the transfer of the passenger carriages to be effected by hydraulic apparatus, irrespective of tide, in a few minutes. The steamers were to be luxuriously fitted up with first and second-class refreshment saloons, and with ladies' and private cabins; and, in addition to the saving of time in the sea passage, and on either coast, the passengers were to have the advantage of being able to secure and retain the seats in their railway carriages throughout the journey between London and Paris and other centres, at the same time that the various saloons and cabins and the decks of the steamers would be at their service. They believed that the extra comfort to the passengers afforded by such accommodation, and by the regularity of the service, was far more important than the saving of time that would be effected. They rejected as insufficient and unsuited to the requirements of the present day, all partial improvements of Boulogne Harbour and the service between that harbour and Dover or Folkestone; and they estimated that these works, and the railway steam-ferry steamers, might be completed within three years, at an expenditure of £2,000,000.

Captain Tyler considers that "the project thus put forward by Mr. Fowler would, no doubt, require some modifications in detail; and it is a question whether it would be worth while to ferry the railway carriages as well as the passengers across the Channel; but the main features, of an improved harbour at Dover and a new harbour south of Cape Grisnez, are sound, if means can be found for meeting so great an expense." He then proceeds to discuss the question of the improvement of Boulogne Harbour; and after describing the existing harbour, says:—"The steam-vessels of the South, Eastern Company, plying between Boulogne and Folkestone, and drawing seven feet of water, can safely cross the bar, which extends for a distance of about 300 metres from the entrance between the piers, at three hours and thirty minutes after high water, giving a range (the ebb and flow being unequal) of five hours and fifty minutes of tide for vessels of that draught. The difference between good and bad weather allows of a quarter of an hour extra, sooner or later, in entering or leaving the harbour, the fall at that period of the tide being a foot or more for every quarter of an hour. It is a singular fact that at the four harbours of Dover, Folkestone, Calais, and Boulogne, the vessels float in their ordinary berths at the quays at nearly the same instant of time; and, indeed, it is the practice to regulate the tidal service for Boulogne by the Folkestone tide-table. The bar at the mouth of the harbour is actually dry occasionally, at very low tides, in March and September," but the condition of this bar and the harbour are improved by the sluicing from the backwater of the Liane, which is stored up for the purpose.

"In the existing state of the harbour of Boulogne, it is not considered safe to employ vessels of greater length than 240 feet over-all, because longer vessels cannot be swung round in bad weather, especially when the harbour is crowded with vessels; and it would be inconvenient in several respects, having reference to passenger accommodation, to construct steamers of the class now in use on a model that would admit of their travelling in either direction without turning round. But larger steamers, with more ample accommodation differently arranged, might, of course, be so constructed, and such a system of construction would tend to obviate the difficulties in the interior of the harbour."

Captain Tyler then proceeds to discuss the various improvements which might be made in Boulogne harbour, so as to render it available for a fixed service, day and night, and this it appears is estimated at £500,000. He goes on to say:—"By way of utilising the existing harbours, Mr. John Grantham, C.E., proposed, two years since, to the directors of the South-Eastern Company (and he has now renewed the proposal), the construction of vessels drawing only 5′ 6″ of water, 400 feet long by 45 feet beam, with a rudder at each end, and a steering apparatus on the paddle-box platform. He would fit up such vessels with grand saloons and good refreshment departments, and ensure safety by a system of cellular construction; and he proposes to attain a speed of twenty-two miles an hour on trial, or eighteen as a working average, with engines of 600 (nominal) horse-power.

"But it is asserted by some of the officers engaged in the performance of these services, that vessels of the class now employed are, upon the whole, the safest that could be devised for the particular duties required of them. It is argued that the sea-passage, in which greater length and size might lead to increased comfort, is comparatively short, while the entrance of the French harbours, by day and night, in certain states of the weather, which is already the more difficult and dangerous part of the service, would be attended with still greater disadvantages. The existing vessels are fitted to encounter any weather with which they can meet in the channel, and are handy for entering the harbours, while longer vessels would be exposed to increased risk at the moment of entering the harbours. The bow of a long vessel getting under the shelter of one pier, and a heavy sea striking her on the quarter, she might be driven against the other pier. There is, no doubt, much truth in this argument. Such a risk must increase in proportion to the length of a vessel, to the narrowness of the entrance to a harbour, to the exposed position of its entrance, as regards winds and currents, and to any necessity which may exist for reducing the speed before entering it; and having regard to the existing state of the French harbours, the employment of longer vessels would, for this reason, be attended in bad weather with greater danger; but the argument would no longer apply if the service were performed from a convenient and well constructed pier on the one, to a similar pier on the other side of the Channel. The longer and larger vessels having increased proportional power, with disconnected engines, so as to be able to use either paddle at pleasure, could be under no disadvantage in approaching the lee side of a pier; and the above argument, therefore, tells in favour of the construction of an extended pier at Boulogne, already referred to, to be used on the French, in combination with the pier at Dover on the English coast, for an improved Channel service.

"The pier at Dover has now been completed to quay level for a length of 1,800 ft., and 170 ft. more will be completed this season. Thus there remains 130 ft., which will be completed at the end of 1870, if the winter be moderate, and if no unexpected difficulties are encountered. This will give a total length of 2,100 ft. This pier was commenced in 1848, and a careful series of soundings was taken about four years ago, under Captain Calver, for the purpose of ascertaining what had been the effect of the pier. It was then found that, although there had been a redistribution of the material of the bottom, there had been no loss of depth throughout the bay, and indeed that the average depth had been slightly increased. The flood tide, which is the stronger, sweeping round the exterior or west side of the pier, forms eddies against the coast beyond, to the eastward, and while scouring and deepening one part of the bay, deposits a portion of the material suspended in it on the eastern side of the pier. The ebb tide being in the same direction with the eddy of the flood, tends to increase the mischief, and the result is an accumulation of chalk, sand, and refuse, under cover of the pier. There has been a little decrease of depth in the immediate neighbourhood of the pier on each side, but there still remains an average depth of about forty feet outside, and thirty-five feet inside, for a length of 800 of the above 1,800 ft. already constructed; and there has of late been a general diminution of beach between Folkestone and Dover. The beach appears lately to have been stopped at Rye and Romney, besides other places, and the supply is now hardly equal to the waste between those places and Dover.

"The whole pier will cost, when complete to a length of 2,100 ft., £725,000, or, on an average, £1,035 per yard. Although the depth to the foundations is about the same as for the last 700 ft., the work is now being done more cheaply, the last contract being let at the rate of £750 a yard.

"There is no reason why this pier should not be used for the accommodation of Channel steamers of larger dimensions, say 400 ft. long, and drawing ten or twelve feet of water, though it might be desirable to lengthen the jetties on either side, to meet increased traffic, to afford separate gangways for passengers and luggage, and to prevent loss of time. The largest vessels used in the transport service, the *Himalaya*, the *Orontes*, and the *Serapis*, make use of the pier at the present time, though not in very rough weather. But the captains of the Channel steamers run alongside of the pier in all weathers, keeping always to the lee side, and, during the past winter, no instance has occurred in which the weather has prevented them from doing so. The only state of the weather that would prevent them from landing passengers from one side or other of the pier, would be during a south-easterly gale, or a very heavy sea from the south-west, such as might occasionally occur about the period of the Equinox. But, for all practical purposes, and with rare exceptions, the pier may be considered, even in its present condition, available for regular communication by steamers of a larger class; and if an extra length were added to it, proportional to the size of the steamer to be employed, and curving to the eastward, so as to face the south and south-east, with a return at the end, there is probably no gale in which the steamers could not be accommodated for passenger traffic.

"The tidal harbour at Dover contains twelve acres of superficial area, and the inner harbour six acres. The 'Pent,' with an entrance sixty feet wide, contains about six acres more of available space. Existing vessels are obliged to wait for the tide to enter the harbour, which is practically dry at low water, and vessels of a larger class would have to do the same, being accommodated with proper moorings on both sides of the pier when not requiring to lie alongside of it. The rise and fall of the tide being, say, nineteen feet at spring tides, and fourteen at neaps, the harbour would not be available for vessels drawing more than, say, ten feet of water at present, or twelve feet of water if certain minor improvements were carried out. To avoid the necessity for turning round in Dover as well as in other harbours, it would be necessary to construct such vessels stem and stern alike, so as to move forward with equal facility in either direction; and in any case, the enlargement and deepening of Dover Harbour, and the deepening of the approach to it, for their accommodation, would be advantageous, if not absolutely necessary. It is, of course, undesirable to go into detail as to the cost of such works until precise schemes have been worked out; but it may be stated roughly that, independently of any extension of the pier, £100,000 would go a long way in making necessary improvements. The population of the borough of Dover is upwards of 25,000, and the tonnage of vessels cleared in 1868 was, outwards, 269,804, and inwards, 321,993.

"The port of Folkestone has been formed by the South-Eastern Railway Company, who have expended upon it altogether upwards of £250,000, including the harbour-works, pier, sea-works, Pavilion Hotel, station and other buildings, and purchase of land. The population of Folkestone was, by the census of 1861, 8,507, and has since increased to, say 10,000. The harbour comprises an area of 16 acres, and its entrance on the east is, since the extension of the pier at Dover, more protected than formerly from eastern gales. The Mole-head rocks, also, in front of the harbour, act, as the tide falls, as a natural breakwater. These rocks extend from Copt Point, which is half a mile east of the pier, in a semicircular direction towards the harbour, and there is eight feet of water at low-water spring-tides inside their southern barrier. West of Folkestone, the beach is protected for a considerable distance by a series of groynes, and the shingle accumulates on one side or the other of these groynes, according as easterly or westerly winds prevail. As the latter winds are most constant, an excess of shingle travels naturally up channel, but it is said to disappear in deep water, in consequence of the set of the currents, as it passes this pier.

"At the head of the southern pier of the outer harbour there is a lighthouse for tidal purposes, and from this point a horn is extended in a south-westerly direction for 445 feet, against which shingle accumulates, and by which the property is secured. From this horn a new pier has been run out in a south-east by southerly direction for 430 feet, having 16 to 17 feet of water (at low water spring-tides) at its extremity, and nearly the same depth for some distance on its western side, diminishing, of course, towards its junction with the horn. On the east side of the pier the depth varies from 14 ft. at the extremity to 10 ft. about half way up the pier; and the company's vessels, 240 ft. in length (over all), touch the ground at very low tides on the inshore end. Larger vessels could not, therefore, be employed without an extension of the pier. There is an iron skeleton lighthouse at the end of this new pier, showing a white light within and a green light without the shoals on either side. Since the formation of this pier, the water has deepened on the western, but shallowed on the eastern side of it. The harbour itself is, like the other harbours referred to, dry at low water, and the ships float in the upper quay berths from two hours to two hours and fifteen minutes before high water, and ground three hours and forty-five minutes to four hours after high water.

"The South-Eastern Railway Company have 11 ships, varying from 185 to 240 ft. in length, and 7' 6" to 8 ft. of water. The speed of the larger vessels averages nearly 16 knots per hour. The traffic of the harbour is, for the most part, in the hands of the South-Eastern Company, and the tonnage varies from 180,000 to 200,000 tons. The merchants import, however, timber and building materials, and occasionally grain. The imports by the South-Eastern boats vary from 15,000 to 18,000 tons, and the exports from 15,000 to 21,000 per annum, the greater part of the goods being of high value. The new pier is only used when the vessels are unable to enter the harbour, which happens perhaps once in four times. The landing-places have an advantage over the jetties at the Dover pier, inasmuch as there are separate gangways for embarking and disembarking passengers and luggage, and the general arrangements, both for passengers and goods, are admirably organised, and the buildings conveniently arranged for the purposes of traffic. The means of access by the Folkestone incline, from the junction with the main line to the harbour, neutralises the effect of the greater proximity of Folkestone as compared with Dover, from London by the South Eastern route; but the company have already obtained a bill for a loop-line to Sandgate, which might be extended along the coast to the station and pier at Folkestone.

"The distances from Boulogne of Folkestone and Dover are practically the same, or about 30 English or 26 nautical miles, the difference being slightly in favour of Dover; while the distance from Folkestone to Boulogne, round the north end of the Varne, would be 27 nautical miles, or one mile more than from Dover outside the Bassure de Baas; and there is the advantage at Dover of the two railways from London running conveniently on the pier, and of the pier itself (on which so much money has been expended) having nearly approached completion, as far as it has yet been authorised. The position of Folkestone would always be under the disadvantage, if larger ships were used at all times of tide, that the well-known shoals, "the Varne" and "the Ridge," on each of which there is at one part only 1½ fathoms of water (at low-water spring tides), lie directly on the route to Boulogne. The South-Eastern boats pass, indeed, over 2½ fathoms of water, at a distance of one and a-half miles from the shallower part of the Varne, and three miles from the shallower part of the Ridge. But it is not necessary that I should refer here to the natural capabilities that exist for the construction of an improved harbour at Folkestone.

"Any report on the general question of continental communication would, however, be incomplete without a cursory reference to the bolder schemes which have been put forward, from time to time, for avoiding the use of steam vessels altogether, by the construction of bridges, or tunnels, or tubes, over, under, or in the bed of the channel, with or without islands, piers, or air-shafts, so as to connect the railway system of England directly with that of the Continent.

"Elaborate plans, which have since been lost, for a Channel tunnel, were laid before the then First Consul, Napoleon Buonaparte, by a French engineer, M. Mathieu, in 1802, and were for some time exhibited in the Luxembourg Palace. After a series of geological investigations, M. Thomé de Gamond also proposed, in 1856, the construction of a tunnel, and his propositions were submitted to the examination of a scientific commission, by order of the French Emperor, in that year. That commission appears to have come to the conclusion that it was desirable to test his investigations by sinking shafts and driving short headings under the sea, at the expense of the two governments. Mr. Low, an English engineer, also laid his plans for a tunnel before the Emperor in 1867, and Mr. Hawkshaw, whose attention has been for some years directed to the subject, caused a trial boring to be sunk on each side of the Channel in 1866, in order to test practically the result of his geological investigations. Mr. Remington published a plan for a tunnel in 1865, and has deposited plans and sections with the Board of Trade. And amongst the names of other proposers or projectors in this direction may be enumerated Messrs. Franchot, Tessier, Favre, Mayer, Dunn, Austin, Sankey, Boutet, Hawkins Simpson, Boyd, and Chalmers. Mr. Austin has of late brought his plan, more than once, to this office.

"Of these various projects, those which have of late made the most progress are, the bridge scheme of M. Boutet and the tunnel scheme presented under the chairmanship of Lord Richard Grosvenor, with Messrs.

Hawkshaw, Brunlees, and Low, as engineers on the English side, assisted by Messrs. Talabot, Michel Chevalier, and Thomé de Gamond, on the French side. The documents in connection with this latter scheme are now before the Board of Trade. The result of the deliberations of a French commission, which was appointed by the Emperor, and presided over by M. Combes, the director-general of the Ecole des Mines, to inquire into this scheme, were on the whole favourable, as regards the geological and engineering parts of the project, though the members of the commission were divided as regarded its financial prospects, the president and two members attaching more importance to the "utility and grandeur of the undertaking," and three other members looking at it from a more strictly economical point of view. The General Council of Ponts-et-Chaussées, presided over by the Minister of Public Works, to whom the matter was afterwards referred, were unable, "upon the documents submitted to them, to decide on the probability of success of the tunnel under the Channel," and considered that "if, from political considerations, the undertaking should be considered useful, the government should follow up the investigations at their own expense."

"In this scheme it is proposed to commence by driving preliminary driftways through the grey chalk, at a great depth below the bed of the Channel, between a point near Dover and another point near Calais; as it is conceived that this material would be easily cut through, and would not be likely to present insuperable difficulties from the influx of water; whereas Mr. Remington, as appears from the printed remarks which he has forwarded to the Board of Trade, selects the line from Dungeness to Cape Grisnez, in order to avoid the chalk, and the fissures which he fears to encounter in it, and to work in the Wealden formation, which would, he believes, afford a greater chance of success.

"In the case of M. Boutet's bridge scheme, an association has been formed for making experiments, two small bridges have been built in France, and arrangements are made, near St. Malo, for a third, a mile in length, to be constructed in two spans of half a mile each. The Emperor Napoleon visited the works of M. Boutet, on a site which has been granted by the French government, on the 8th instant, and his Majesty is stated to have expressed himself favourably with regard to the project.

"This bridge is intended to cross from Dover to Blancnez, and is advocated, in a paper forwarded on the 27th June to the Board of Trade, as (1.) being less costly than a tunnel; (2.) occupying less time in construction; (3.) giving no trouble in ventilation; (4) avoiding the danger of sudden inundations.

"Mr. Charles Boyd has forwarded to the Board of Trade a pamphlet, containing his proposal for a 'marine viaduct' from Dover to Cape Grisnez, constructed with iron girders on 190 towers, 500 feet apart, and 500 feet above the sea, and he estimates the cost of such a bridge at £30,000,000.

"Mr. Hawkins Simpson has addressed the Board of Trade, under date the 25th June, on the subject of working a submarine tunnel on a pneumatic system, which he has termed his "Eolian system," for which he claims cheapness, expedition, superior ventilation, and greater utility.

"Mr. Alexander Vacherot has submitted to the Board of Trade a scheme, on which he has several years been engaged, and which he laid before the Emperor of the French in 1856, for 'laying on the bed of the sea a tunnel made or formed of concrete, so as to form, when completed, a monolith.' He would construct it on the shore, and 'draw it down to its place in sections.' And he considers that greater economy and security might thus be obtained, than by the other methods that have been proposed."

With regard to these various projects, Captain Tyler, though unable to convince himself of the feasibility of any bridge scheme, conceives "that it might be wise to test the practicability of a tunnel scheme by means of preliminary driftways. It is probable that, even if any of them should hereafter be carried out in practice, they could not go forward otherwise than under the supervision of, and a previous guarantee from the two governments; and obvious that, as at least 10 or perhaps 15 years may elapse before they could be made available for traffic, improvements in the shape of more convenient and larger steam vessels are required in the meantime for the better performance of the service." In this view of the case, he sums up the conditions of the problem as follows:—

"The steam-packet service between England and France, which is in fact a service between Great Britain on the one hand, and Europe and the East generally on the other, is much in need of improvement. There are now, exclusive of the routes by Ostend and Antwerp, 310,000 passengers a-year to be provided for, of whom 142,000 travel by Calais, as the mail route; and those numbers are capable of great augmentation on greater facilities and increased comfort being afforded. The existing steamers, restricted as to their dimensions for want of better pier and harbour accommodation, are not proportionate to the importance of the service. Larger vessels, with less movement in rough weather, more shelter, and better accommodation generally, would do much to mitigate the discomforts of the sea passage; and even contemplating the successful issue of a tunnel project, say in 10 or 15 years, these improvements are much required, and should be effected in the meantime. But larger vessels cannot be employed for a fixed service until better provision is made for embarking and disembarking passengers, especially on the French coast. The pier at Dover is not only ready, but has frequently been used for military transport-vessels of the largest size, though certain improvements are required in the jetties for greater convenience in embarkation and disembarkation. The difficulties in the way of fitting the harbour of Calais for the reception at all times of larger vessels are very great, but by a judicious extension of the west pier at Boulogne, similar accommodation might be provided on the French side. At a cost of, say £100,000 at Dover, and £500,000 at Boulogne, the desired object might, apparently, be attained in the most economical and most expeditious manner. By the adoption of steamers capable of moving with equal facility in either direction, the difficulties incidental to turning round in small harbours may be avoided; and the existing harbours at Dover and Boulogne might, with certain modifications, be made available, to some extent, for improved vessels. The question might thus be temporarily solved, if the two governments were not prepared to carry out a larger scheme. If they are prepared to face a greater expense, there is the more extensive project of Mr. Fowler, for constructing, at a cost of two millions of money, special harbours for special steamers; and there can be no doubt that this project presents — whether the railway carriages be ferried over or not—a more comprehensive mode of dealing with the subject. The relative distances may be stated to be:— between Dover and Audresselles, 24, Dover and Calais, 26, and Dover and Boulogne, 30 English miles; while the passage to Boulogne, though longer, is admitted to be better than that to Calais. Either by the construction of new harbours at Dover and Audresselles, at a cost (as estimated by Mr. Fowler) of £2,000,000, inclusive of steamers, or by the improvements above suggested at Dover and Boulogne, at a cost of £600,000, exclusive of new and improved steamers, the immediate object should be to provide an improved fixed service, irrespective of wind and tide, between London and Paris in eight hours; and it would appear to be desirable now to refer the whole matter, through the Foreign Office, for the consideration of the French government, with a view, perhaps, to the appointment of an international commission, in which that government would, no doubt, readily acquiesce, and without which the important interests involved could not be authoritatively dealt with, nor the general question satisfactorily decided."

The *Times* of the 29th July, in commenting on Capt. Tyler's report, says:—

"The Channel between Dover and Calais remains to be overcome, and there is no lack of schemes by which that purpose may be accomplished—schemes of chain and tubular bridges, of submarine tunnels, of tunnels to be laid on the bed of the sea, of tunnels on the 'pneumatic system,' on the 'Eolian system,' of marine viaducts to be constructed with iron girders on 190 towers, at 500 feet intervals, and at a height of 500 feet above the sea level—the latter undertaking to be effected at the cost of only £30,000,000. All these projects have been examined by Captain Tyler in his report on 'Improvements in the Channel Passage,' just laid before the House of Commons, and he has been led to the conclusion that while 'he cannot convince himself of the feasibility of any bridge scheme,' he would deem it wise 'to test the practicability of a tunnel.' The tunnel, however, if at all possible, is a design which it would take ten or fifteen years to bring to maturity; and, in the meanwhile, it is natural to wish that some immediate improvement should be introduced into the present mode of communication. The number of passengers crossing the Channel, between the French and English ports, averages 316,000 yearly, and of these 142,000 give the preference to the Dover and Calais route. Great as is the intercourse between England and the Continent, however, with the present means of communication, it is clear that a new impulse would be given to it if greater facilities and increased comfort could be secured. That the present means of communication admit of very considerable improvement is a fact about which many of us have frequent opportunities of satisfying ourselves. The gallant little steamboats plying between Dover and Calais, or between Folkestone and Boulogne, are very possibly the best that could be contrived under the circumstances. They have to contend against the most capricious of seas, and acquit themselves with perfect safety and praiseworthy punctuality, in spite of violent gales and the darkness of wintry weather. With such shallow ports as we have, especially on the French coast, it is impossible to employ vessels drawing more than seven to eight feet of water; and it is with difficulty that even these can sometimes get into harbour or land their passengers. Every one feels how much the discomfort of the sea passage would be mitigated by the use of larger vessels, with less movement in rough weather, more shelter, and better accommodation in every respect; and all this could be effected even while we waited for the eventual accomplishment of a tunnel scheme; precisely as the Summit Railway over Mont Cenis is already a great improvement on the old diligence, and enables us to bear with patience the delay that still separates us from the opening of the Alpine tunnel. In order that larger vessels may be applied to the Channel service, it is necessary that better ports than any in existence should be provided; and it is with that view that Capt. Tyler has been instructed diligently to survey the coasts on either side. The shifting sand and the travelling shingle raise almost everywhere serious obstacles to free navigation. Captain Tyler feels convinced that it is futile to attempt any improvement at Calais; but he thinks that, by an outlay of £100,000 at Dover, and £500,000 at Boulogne, it might be possible so to prolong the piers of both those harbours as to allow steamers of a sufficiently large size to approach them in all weathers. Boulogne, however, is only convenient to travellers between London and Paris, while Calais has the advantage of being the great centre of communication, by way of Brussels and Cologne, with the Rhine, the North of Europe, and Northern and Southern Germany. Although Captain Tyler, as a step in advance, recommends the Dover-Boulogne route, he also adds that, if the two governments are not unwilling to carry out a far larger scheme, they can do no better than give full development to the project of Mr. Fowler, which has already been under examination for the last six or seven years."

After describing Mr. Fowler's scheme, as given in Captain Tyler's report, the *Times* goes on to say:—

"There is nothing absolutely new in Mr. Fowler's project, and the only wonder is that so many years should have elapsed before an attempt was made to apply to the British Channel on a large scale that system of railway ferry-steamers which has already been so long in operation in America, on the estuaries of large rivers and on the inlets of great lakes. At the time of the Danish war of 1864, the idea of introducing these large ferry-boats for the traffic over the Great and Little Belts was already attained at Copenhagen, and if the plan was not carried into effect it was owing only to the disastrous issue of the national contest, and the change in the destinies of the Elbe Duchies. With a good, well-sheltered harbour, and a pier jetting out into deep water, and steamers with a rudder at each end and a steering apparatus on the paddle-box platform, the embarkation and disembarkation of a railway train, however long, present no difficulty and cause no delay. But, after all, it would matter little whether the railway carriages were ferried over or not, and the usefulness of the scheme in that respect must also depend on the gauge of the lines on either side of the Channel. What is of greater moment is 'an improved harbour at Dover and a new harbour south of Cape Grisnez.' It is the thorough independence of any consideration of wind and sea; the extra comfort to the passengers afforded by the accommodation of large vessels, the regularity of the service, the economy of time, the almost total immunity from the great scourge of sea-sickness, the safety from drenching showers and cutting winds at landing, the avoidance of a dark walk or of the omnibus drive from the landing-place to the station, of the delay, the hurry, the vexation, confusion, and annoyance inseparable from a first experience of either French or English soil, which Mr. Fowler's plan promises to secure, and which we hope to see secured."

APPLICATION OF SEWAGE IN FRANCE.

The City of Paris has recently terminated a series of experiments, which have occupied two years, in the direct application of sewage water, and also in the purification of the same, and the application of the solid deposit and the partially purified water. The experiments were entrusted to engineers of *ponts-et-chaussées*, and those made on the ground were checked by others, carried on with great care, and at fixed intervals, in the laboratory. The results are embodied in an elaborate report, by MM. Mille and Durand Claye, which has been presented to the Academy of Sciences. The experimental establishment was situated at Clichy, within a few hundred feet of the mouth of the great sewer, which there pours the entire sewage of the city into the Seine. The amount of the sewage is, in round numbers, 200,000 tons per day; and although the contents of the cesspools of Paris are not allowed to pass into the sewers, the condition of the river is already much complained of; the mud on the banks emits noisome gases, while the mineral matter forms bars, which constantly have to be removed by dredging. The experimental works employed one four hundredth part of the whole amount of sewage passing through the collector.

In the first place, vegetables of various kinds, including melons, fruit, and flowers, were cultivated-in ridges, the sewage water being allowed to circulate in every direction in deep trenches, so that the fertilising matter went direct to the roots of the plants, and never touched their leaves. Patches of grass were cultivated by direct irrigation, and the results were highly successful. In the winter, large quantities of sewage were pumped over spare ground—a poor, virgin subsoil—and this being afterwards planted with vegetables, also gave a very satisfactory result. One of the most effective experiments was made on a piece of wheat land, half of which was manured with the precipitated sewer matter and the other half with common farm-yard manure. The extent of land was exactly the same in each case, and the quantity of manure the same, namely, fourteen tons per acre, and the results were curiously similar, the quantity of wheat in each being the same, and the quality identical; the only difference was that the farm-yard manure gave a rather larger value in straw, to the extent of a few shillings per acre. The most careful analysis exhibited no difference whatever in the grain, and the straw was simply two inches shorter in one case than the other.

The value of the whole of the sewage of Paris is estimated theoretically at £280,000 per annum, the precipitated matter representing three-sevenths of that sum, and the purified water the remainder. The engineers engaged on the work are of opinion that direct application and purification must go hand-in-hand, and the cost of distribution and purification together is set at from two to three centimes (about one farthing) per ton. The Paris sewage, not containing the cesspool matter, is not rich; it contains only about six pounds of solid matter per ton, of which four pounds consist of mineral matter. The purification is performed by means of alum, the quantity employed being rather less than seven ounces per ton, and the result is that the precipitate contains nearly all the mineral matter, three-fourths of the organic matter, with the phosphoric acid, &c., in all four pounds, while the purified water retains the remainder of the nitrogen, all the alkalies, with a small amount of organic and mineral matter.

These first experiments have been brought to an end, and a new one was commenced on a much larger scale. On the opposite side of the Seine is a large tract of land, very poor, and now yielding miserable crops of cereals and other produce. A main is being laid across a bridge now building, to convey one fortieth part of the whole sewage to this sandy plain, and the farmers will be supplied for a time with the sewage water gratis, in order to fix, in a practical manner, its fertilising value. The first experiments have cost the city about £10,000, and the future expenses will be very large, but the object in view is one of great importance, and is being carried out with great determination and skill. It is believed that this arid plain may be converted into valuable market gardens, which yield a good revenue near Paris, while corn gives miserable results. It has been proved, in fact, that land producing only 800 to 900 francs per hectare can be made to yield, without impoverishment, 4,400 francs in vegetable, by the application of sewage. If this new experiment should succeed, as it promises to do, the next question is how to make similar use of the other 39-40ths of the sewage; and this includes the very serious question of finding customers for the precipitated matter, which is found in practice to be of the value of eight shillings per ton. Failing this, the next question would be to find economical means of conveying the sewage to a distance, for irrigation of the crops during the summer months, and for natural purification and deposit of the fertilising matter on the land during the winter. The French engineers have studied with attention all that has been done in England and Scotland, and the experiments in which they themselves are now engaged cannot fail to assist materially the solution of this important problem of returning to the soil the living principles of which it has been despoiled.

Manufactures.

MINING SCHOOL OF ST. ETIENNE.—The object of this school is the training of young men for directors of works, inspectors, and foremen. The education is gratis, and includes, besides the working of mines, knowledge of minerals and mineral deposits, the art of assaying and treating ores, the elements of mathematics, the most essential principles of resistance, the nature and application of materials employed in the construction of works connected with mines, metallurgical works, tramways and roads, book-keeping by double entry, surveying, and plan-drawing. Pupils, on leaving the school, receive diplomas of capacity, according to the degrees of their proficiency. Pupils are admitted between the age of sixteen and twenty-five, after an examination in the following subjects:—The French language, arithmetic, geometry, algebra, rectilinear trigonometry, descriptive geometry, and chemistry (as in the examination for the degree of bachelor in science) natural philosophy, the elements of linear and free-hand drawing, and the working of problems in descriptive geometry. Candidates are first examined by a mining or other engineer, and, secondly, by the council of the school. A report is then made to the Minister of Agriculture and Commerce, who decides on the number to be admitted to the school.

Commerce.

FRENCH BRANDY.—Cognac, with its brandy distilleries, and its 24,000 inhabitants, is said to be one of the wealthiest towns in the world, in proportion to its size. The quantity of brandy exported from Tounay-Charente, in 1868, was 9,187,416 gallons, nearly the whole of which was exported to the United Kingdom. In 1863, the exportation was only 3,988,358 gallons; in 1866, it reached 11,562,210 gallons; and, in 1867, the quantity was 9,770,420 gallons. In recent years there has been a large quantity shipped in bottle instead of in casks, and although the brandies exported in 1868 show a slight diminution compared with 1867, yet the number of cases containing bottled brandy shipped has increased from 558,086, in 1867, to 627,603, in 1868, of which 576,989 were sent to the United Kingdom. The least quantity contained in a case is 12 bottles; many have more, but, reckoning only 12 in a case, the exportation would amount to 7,500,000 bottles. The brandy exported from Charente, in 1868, is valued at £1,887,678, of which £1,733,854 was conveyed in British bottoms, and £153,824 in foreign, the latter mostly to Australia. Notwithstanding the slight diminution in the quantity last year, there was an augmentation in value. The vintage of 1868 was severely checked by some late frost, and the unexceptional dry summer operated in the same direction; but when the grape was subjected to distillation, the alcohol contained in the juice was found to be considerably above the average, and the brandy produced gave a given quantity proportionally large. It is, therefore, believed that the exports will continue on an extensive scale in the present year.

Colonies.

THE JAMAICA BOTANICAL GARDENS AND CINCHONA PLANTATIONS.—A report on the progress and condition of the botanic garden for last year, by Mr. Robert Thomson, superintendent, has been kindly forwarded to the Secretary of the Society of Arts, by the Secretary of State for the Colonies. From this it appears that from the Castleton Garden, during the year, nearly two thousand plants have been distributed. The number of species, however, are comparatively few, partly owing to the infancy of the establishment, whereby the majority of the species have not attained to the period of reproduction, and partly owing to the paucity of species of which the garden consists. Indeed, with regard to ornamental species, the garden possesses but few not already commonly diffused over the island. Now that the permanency of the present site is ensured by the government, there will be no obstruction to the large importation of a liberal assortment of all plants that are likely to be turned to account as economic products or as horticultural species, and Dr. Hooker, of Kew-gardens, having kindly offered his assistance and influence, the garden will thus soon be enriched and elevated to a new sphere of usefulness and efficiency. Among the plants introduced during the year is one of ipecacuanha, which is extremely rare, and a very shy grower. A Ward's case of Assam tea, containing upwards of six hundred plants, arrived in excellent condition from India, *via* the Colonial-office; an experimental two-acre plantation of this will be established in a few months. Manilla hemp, previously cultivated here, but now lost, has been re-introduced, and *Musa ensete*, the most magnificent of the banana tribe, attaining a height of forty feet, with leaves twenty feet long. The black-pepper, since its introduction last year, has propagated to thirty plants, and the jalap to about twenty plants. A run of virgin forest land, containing six hundred acres, was acquired early in 1868, for the purpose of cinchona plantations. This property, in elevation, ranges from four thousand feet to six thousand feet above the sea, situate on the southern slope of the Blue Mountain range, on its western declension, distant about twenty-four miles from Kingston, and embracing a great variety of aspects, with several streams or small rivers, and with excellent soil, admirably adapted to the requirements of the cinchona. Possession was obtained in May last year, and operations commenced, in the felling and clearing of the forest to the extent of fifty acres, which was ready for being planted out in August. During the lapse of these months, a violent drought, such as has been seldom witnessed, prevailed over the higher mountains, but which was most propitious in accelerating the preparation of the land. In September and October, upwards of forty acres were planted with fine species, all of which have taken kindly to the soil; indeed thousands have, in this short time, grown five to six inches. The number of plants now permanently planted out is about twenty thousand, which it was expected would be augmented to thirty-five thousand during the present year. A neat and substantial green-house, capable of accommodating about eight thousand young plants, also a hot-pit, heated by a furnace and flue, thus affording the requisite command of bottom-heat, to render possible the propagation, from cuttings, of some two thousand plants a month, have been erected, at a height of four thousand eight hundred feet above the sea, and placed adjacent to the site intended for the house for the superintendent. A shed, fifty feet long by twelve wide, has also been built for the accommodation of labourers. During the year seeds of the following kinds of cinchona have been received from Ceylon, through Dr. Hooker:—*C. succirubra*, *C. officinalis* and *C. pahudiana*. Of the first-mentioned species, owing to the large extent already planted, eight thousand to ten thousand plants were advertised for sale in July, 1868, but the announcement of sale was not generally responded to, hardly two thousand plants having been applied for. This announcement contrasts unfavourably with the first notification of the sale of cinchonas in India, and at a price one hundred and fifty per cent. higher than those offered in Jamaica. Steps have been taken, or are about to be taken, by the Indian government to commission an agent to proceed to New Granada, to collect all the remaining valuable species not yet introduced into that country. Jamaica will, doubtless, as hitherto, share in profiting by this new acquisition of several important kinds. The Madras and Bombay Cinchona Commission, appointed to ascertain the febrifuge value of alkaloids other than quinine, have concluded, from the data before them, that the alkaloids hitherto but little valued in medicine (cinchonine, cinchonidine, and quinidine), are scarcely, if at all, inferior as therapeutical agents to quinine. What the exact differences may be in their physiological and therapeutical action is a question, the answering of which may fitly be deferred until more data have been collected in reference to the new alkaloids.

Road-making in South Australia.—Very large sums of money have been spent on the main roads of this colony, which now possesses, perhaps, the finest roads in all Australia; and it is now stated that the keeping of the roads in repair will tax the revenue of the colony to the extent of £50,000 annually, and that a corresponding sum will be required for the construction of new roads. It is suggested that, where new country is to be opened up for agricultural purposes, it would be cheaper to construct light railways, with cheap macadamised roads as feeders, rather than to employ expensive metal throughout.

Cultivation of Beet in Tasmania.—A Hobart Town paper says that considerable interest is at present being taken in that city with regard to the cultivation of beetroot for the manufacture of sugar. A sample of very good quality had been shown at an agricultural show, and it is generally believed that the climate and soil of Tasmania are favourable to the growth of root-crops, and the Royal Society of the colony are now instituting inquiries as to whether the manufacture of sugar from beetroot could profitably be carried on. A committee appointed last session to consider what manufactures should be encouraged by government, reported favour-upon beetroot sugar, and recommended that upon every 500 tons of sugar manufactured from beetroot by one manufacturer in one year, a bonus of £500 should be given, and a similar amount guaranteed on the same conditions for three years from the commencement of the manufacture. It is very likely that the subject will soon be practically taken up, and steps adopted for the manufacture in Tasmania.

Sheep Stations in New South Wales.—A little more demand for sheep stations has recently taken place. One or two purchases of sheep properties have been made, though at a considerable reduction in price, buyers seeming only inclined to purchase where they can secure bargains.

Railways in Victoria.—The following returns from the railway department of Victoria show the gross revenue of the Victorian railways to the following dates, from 1st January of each year:—

	£	s.	d.
15th June, 1865	247,009	3	11
21st „ 1866	262,089	12	4
20th „ 1867	247,028	15	1
18th „ 1868	258,868	1	4
17th „ 1869	259,789	1	8

The returns of the Hobson's Bay and Melbourne United Railway, up to 10th June, show a steady improvement, the aggregate from the beginning of the year amounting to £61,118 10s. 6d., against £59,833 9s. 11d. for last year, showing an increase of £2,285 6s. 7d.

Quartz Mining in Victoria.—Quartz mining seems to be taking the place of alluvial, and considerable attention has of late been turned to it, and, according to the statistics, it appears with good reason. The total number of persons engaged in mining is 67,991, of whom 52,537 are working the alluvial, and 15,454 the quartz mining, the total yield produced being 341,716 ounces, of which the alluvial produced 21,643 ounces, and the quartz reefs 125,372 ounces, or an average of 4 ounces 2 dwts. for each person engaged in alluvial workings, and the average to each quartz miner is 8 ounces 2 dwts., or nearly double that of the alluvial miner.

Queensland Imports and Exports for 1868.—The total imports amount to £1,880,625, and the exports to £2,086,738, the excess of exports over imports being £206,113. This return, however, is incomplete, as the returns of the imports and exports from Sweer's Island, the port of the Gulf country, are not to hand; but though they may affect the actual figures, yet they will not be sufficient in amount to affect the general result. As might be expected, the largest imports were at Brisbane, where the receipts were £1,271,536. The following return shows the countries from which the principal imports are received:—

Great Britain	£431,658
Australian Colonies	1,443,562
New Zealand	500
South Sea Islands	5
South America	4,900
Total	£1,880,625

The statement below shows the countries to which the exports from the colony have been made, and the amount in each case;—

Great Britain	£505,277
Australian Colonies	1,579,494
New Zealand	900
New Caledonia	870
South America	46
China	1
South Sea Islands	144
Guam	6
Total	£2,086,738

Notes.

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BREAD MAKING.—In his address to the Chemical Section of the British Association, Dr. Debus said:—"A very important paper has been published by Professor Liebig on the improvement of the nourishing qualities of bread. Certain quantities of phosphates and other salts form necessary ingredients of wholesome food. Now, it is well known that most of these salts which exist naturally in wheat remain with the husk. Liebig proposes to add salts, of a nature similar to those remaining in the husk, to the flour, and, at the same time, to substitute for the carbonic acid developed by fermentation, gas liberated from iodic carbonate. The bread prepared according to Liebig's recommendation is said to be of excellent quality, and to exceed in value bread made by the ordinary method."

NEW COPYING INK.—A German chemist gives the following recipe for copying ink:—One ounce of extract of Campeachy wood dissolved in about five gallons of hot water, with the addition of a quarter of an ounce of crystallised carbonate of soda. When the solution is completed, add an ounce of ordinary glycerine of commerce, of specific gravity 1·25, 15 grains of neutral chromate of potash dissolved in a little hot water, and a quarter of an ounce of gum powdered and reduced to mucilage by means of a little water, the whole mixture to be well stirred together. This ink is said to keep good for an indefinite time, in closed bottles, to have no effect on steel pens, and to copy well, even after the writing has been done for a considerable time. It has this peculiarity, however, that it will not copy by pressure. The method is to moisten the copying paper in the usual way, lay it upon the writing, cover the former with a sheet of smooth writing paper, and rub the latter with a paper-knife, using a moderate amount of pressure.

LIBRARY OF THE BRITISH MUSEUM.—During the past year 42,331 volumes and pamphlets were added to this library (including books of music and volumes of newspapers), of which 992 were presented, 6,099 were received in pursuance of the laws of English copyright, 346 were received under the international copyright treaties, and 34,894 were acquired by purchase. There were added also 33,403 parts of volumes (or separate numbers of periodical publications and of works in progress). A total of 1,145 sets of newspapers were received from the Inland Revenue offices of the United Kingdom, of which 131 were published in Scotland, 138 in Ireland, 238 in London, and 638 in the rest of England. Of music, 2,121 pieces were acquired, each piece complete in itself, of which 1,527 were received by English, and 576 by international copyright, and 18 were purchased. Of 779 portions of musical works in progress, 473 were received by English, and 306 by international copyright, and 253 works of music of greater extent than single pieces were also acquired, comprising 25 by English, 66 by international copyright, and 162 by purchase. A total of 5,773 articles were received in the department, not included in the foregoing enumeration of volumes and parts of volumes, consisting of playbills, single pieces of music, broadsides, songs, ballads, and other miscellaneous items, giving a grand total of 81,507 articles received during 1868 in the department.

EDUCATION OF THE AGRICULTURAL POOR.—The *Saturday Review* (28th August) says:—"All the friends of the agricultural poor agree that to educate them better is the first thing needful. The two main questions are, what the education given shall be like, and how it shall be provided. Amongst the poor, as in every other class, there are a few clever boys, and a great many—a very great many—stupid boys. No scheme of education will deserve to be called national if it does not secure a chance in the world to the clever children of the poor; and it was one of the main merits of Mr. Forster's Endowed Schools Bill, last session, that it paved the way for carrying out a great scheme, under which such a chance would be in the reach of the few among the children of the poor who possess exceptional ability. Nothing would tend to comfort and animate the poor so much as the certainty that they were not born under a fatal spell that condemns every one of them, whatever may be his natural gifts, to equal and inevitable obscurity. And in England this is especially wanted. For the Church of England is the only Christian Church that cannot offer the poor one way of exercising a calling above that of the day-labourer, by admitting them into the ranks of the ministry. It is quite idle to ask that the Church of England should alter its system, for the great excellences of the Church are bound up intimately with the requirement of a standard to which, as things now are, no poor man can attain. The great mass of the poor can, of course, only learn what is compatible with early hard work. But even here it may be a great mistake to set the standard too low, and to pronounce that English lads are inherently incapable of an education such as that which is the pride of the poorest Scotchman. How the education is to be provided is a difficult question, which will be debated warmly enough next next year, and on which we need not now enter. The only two postulates with which we must set out are, that an education such as the wisest and most experienced educators of each generation think the best and most suitable shall be offered to every girl and boy in England; and that, somehow, the money that is requisite, however large it may be, must be found. If we once enter on the discussion with these two bases as beyond question, it cannot be an insuperable puzzle to find out how much the poor can learn, who is to teach them, and who is to pay the cost."

PROPOSAL TO ILLUMINATE BEACONS BY ELECTRICITY.—It appears, by the *Scotsman*, that, for some time past, Mr. T. Stevenson, C.E., has been engaged in prosecuting a series of experiments, with the view of testing the practicability of illuminating beacons and buoys at sea by the electric light, produced by means of a battery on the shore. These experiments have been attended with a remarkable degree of success, and were conducted in presence of deputations from the Board of Trade, the Trinity-house, and the Commissioners of Northern Lights. With the view of having this application of electricity thoroughly tried, Mr. Stevenson has had a submarine cable laid between the East Breakwater of Granton Harbour and the Chain Pier at Trinity. The operator occupies a station near the centre of the breakwater, and the light is shown at the point of the pier, the current being thus transmitted a distance of fully half-a-mile. The light is shown in front of an ordinary holophote reflector, and appears to be thoroughly under the control of the operator.

Means of Ascertaining the Age of Documents.—A communication has been made to the Academy of Sciences of Paris by M. F. Carré, which may be of use in proving the age, or in detecting forgery, in the case of written documents. The methods consist either in taking a press copy of the manuscript, by means of a weak solution of hydrochloric acid, or in submitting it for a considerable time to the action of the same solution. When the ink of the writing is very old, it is almost unaffected by acids. When not more than eight or ten years old, a press copy of the writing may be obtained with the aid of a solution containing one-twelfth part of common hydrochloric acid of commerce, almost as easily as with water and fresh manuscript. The power of taking copies in this way decreases in proportion to the age of the manuscript; after thirty years the copy is usually illegible, and a manuscript bearing date 1787 produced only a few traces almost imperceptible. The process of washing in the solution produces a reverse effect. Writing which had been executed for periods varying from a few months to ten years disappeared completely after remaining a few hours or a few days in the same solution, while writing thirty years old remained legible after fifteen days' immersion. Oxalic, sulphuric, or nitrous acid produces precisely the same results. The first mode is convenient for obtaining copies which have become impossible with water alone, and the little acid that remains on the paper may be neutralised by holding the manuscript for a few seconds over a vessel containing an aqueous solution of ammonia. The second process, of course, is destructive in its action, except in the case of old documents.

Lighting of Railways.—According to the American journals, a novelty in railway management is to be introduced by the Erie Company, who propose to illuminate the whole line of that road by night by electric lights at the ferries, in the tunnels, on all dangerous curves, and on every engine. Mr. E. C. Morse, who has charge of the matter, states that he has made several important improvements, among others a plan for preserving the carbon points from wasting away, and keeping them for months in a good condition, a self-sustaining battery, and an invention by which the turning of the wheels of the engine shall collect electricity for use in illumination. There will be a light at each end of the ferry, which, it is believed, will make a collision practically impossible on the darkest and foggiest night. Even with the diminution of light caused by the jarring of the locomotive, it is estimated that the head-lights will show the track to the engineer on a straight line for three miles.

Patents.

From Commissioners of Patents' Journal, September 3.

Grants of Provisional Protection.

Alcoholic liquors, distilling—2490—W. Byrne.
Artificial fuel—2413—D. Barker.
Bats for felting and other purposes—2492—L. B. Fortin and J. Ferrabee.
Blasting compounds, explosive—2500—P. A. Blake.
Bullets, &c., apparatus for affording protection from—1983—J. Stringfellow.
Carriages for locomotion by manual labour—2451—R. H. Charsley.
Carriages, &c., apparatus for applying electro-magnetism as a motive power to—2485—J. Jones.
Caustic ammonia and ammoniacal salts—2482—F. Braby.
Cloth, &c., manufacturing—1219—P. R. Hodge.
Combing machines—2504—N. Delandtsheer.
Copper, extracting from its ores—2503—T. Gibb and C. Gelstharp.
Denture or appliance for carrying and supporting artificial teeth in the mouth by suction—2437—G. Ash.
Feet, machinery for manufacturing coverings for the—2479—H. N. Moyon and J. E. Lemercier.
Felting, shackle and roller end for hardening machines for—2507—T. Whitehead.
Fire-arms, &c., breech-loading—2427—W. Richards.
Flax, &c., spinning—2449—J. Lawson and E. G. Fitton.
Flax, &c., machinery for breaking the woody parts of—2516—J. E. Hodgkin.
Food, preserving articles of—2345—E. Beanes.
Furnace doors—2467—T. Parkinson.
Furnaces, &c.—2440—H. Pinkus.
Gas—1683—H. Holdrege.
Gas lamps, posts for—2509—W. R. Lake.
Gas retorts, &c., charging and discharging fuel in—2445—H. A. Bonneville.
Glass houses—2484—S. Robinson.
Iron, &c., welding plates of—2487—W. S. Sutherland.
Kilns for burning bricks, &c.—2439—J. Mitchell.
Ladies' panniers or bustles—2296—T. W. Lockyer.
Lead, producing white pigments from—2443—J. G. Dale & E. Milner.
Leather, utilising waste—2481—J. Blakey.
Life buoys—2496—G. W. Morgan.
Lifting jacks for lifting railway rails—2415—J. Deas & R. C. Rapier.
Liquids, measuring, &c.—2491—H. J. H. King.
Locomotive engines and carriages—2457—R. F. Fairlie.
Looms—2229—W. K. Stock.
Maps, &c.—2455—J. Williams.
Marble, &c., composition in imitation of—2431—W. Matt.
Metals, machinery for forging, &c.—2473—J. Mitchell.
Motive-power, obtaining—2476—J. J. E Mayall.
Motive-power, applying—2383—E. A. Curley.
Motive-power, obtaining—2508—W. R. Lake.
Ores, &c., apparatus for crushing, &c.—2411—W. Davis.
Paint, manufacturing—2493—A. V. Newton.
Patterns for antique lace making, &c.—2402—J. B. Austin.
Pen-holders—2459—W. R. Lake.
Railway trains, communication in—2417—H. Hudson.
Railway trains, communication in—2447—S. Harvey.
Scents, &c., obtaining from flowers, &c.—2039—W. Pidding.
Scissors for gathering flowers and fruit—2441—J. Blyde.
Screw propellers—2486—W R. Lake.
Sewing machines—2477—W. Campion.
Ships, compositions for coating the sides and bottoms of—2418—D. A. Gibbs.
Ships, extinguishing fires in the holds of—2494—W. Allan, W. Payne, and A. B. Fraser.
Slide valves—2478—A. Gilchrist.
Smoke, consuming—2429—J. Kenyon.
Soap, &c.—2328—J. T. Way.
Steam boilers—2488—A. Wigzell.
Stone, &c., cutting and dressing—2495—A. Neill.
Subaqueous ways, construction of—2512—Z. Colburn.
Textile fabrics, manufacturing—2253—R. G. Lowndes and J. Reid.
Textile fabrics, &c., apparatus for plaiting—2419—E. J. Grabham.
Toilet quilts, &c.—2497—J. Barlow.
Vehicles, springs for wheeled—2499—A. M. Clark.
Velocipedes—2514—H. Taylor.
Velocipedes—2498—F. Coote and F. W. Cranch.
Window blinds—2461—J. Checketts.
Wood, &c., imitations of and substitutes for—2510—J. H. Johnson.
Wool, &c., machinery used in the treatment of—1749—J. and S. W. Varley.
Wool, &c., machinery for carding, &c.—2505—H. A. Bonneville.

Inventions with Complete Specifications Filed.

Braiding machines—2528—W. R. Lake.
Fibrous materials, machinery for carding, &c.—2537—W. R. Lake.

Patents Sealed.

654. A. A. L. P. Cochrane.
667. C. Tighe.
669. F. Windhausen.
674. W. B. Waterlow.
677. R. Badger.
687. J. A. McElroy.
831. W. T. Sugg.
898. T. Shakespear & G. Illston.
1055. W. Powell.

From Commissioners of Patents' Journal, September 7th.

Patents Sealed.

694. L. M. Ruiz.
695. H. Tylor.
723. R. M. Caffall and D. Miller.
724. J. Henderson.
729. W. Walker.
731. B. Britten.
733. J. Sax.
740. D. Johnson.
744. G. Glover.
748. C. H. Cooper.
769. C. E. Brooman.
770. L. Labadie.
773. H. C. Bartlett and A. G. Southby.
819. C. F. Claus.
827. A. de Pindray.
828. W. R. Lake.
844. W. R. Lake.
871. M. Sigler.
906. F. Hurd.
913. J. T. Calow.
933. B. J. B. Mills.
998. H. A. Fletcher.
1243. A. Borgnet.
1312. L. Isaac.
1400 G. T. Bousfield.
1508. S. W. Clark & W. R. Sykes.
1900. W. R. Lake.
1905. W. Clarke and E. Walker.
2092. J. Dewar
2149. J. W. Ormiston.

Patents on which the Stamp Duty of £50 has been paid.

2246 J. Owens.
2287. W. P. Bardell & W. Powell.
2266. C. E. Brooman.
2297. J. Asquith & J. W. Asquith.
2304. C. E. Brooman.
2308. C. Catlow.
2294. T. Berney.
2277. W. T. Sugg.
2316. W. Clark.
2364. C. P. Stewart and H. Chapman.

Patents on which the Stamp Duty of £100 has been Paid.

2467. W. A. Richards.
2476. A. J. Alderman.
2491. G. Ritchie.